

水素分子の各種疾患又は疾患モデルに対する効果を報告した文献

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対象器官 又は疾患	疾患又は疾患モデル	著者及び報告年	使用動物種				投与形態				
			細胞	齧歯類	その他動物	ヒト	培養液	生食	水	ガス	その他
脳	脳梗塞	Ohsawa et al, 2007; Ono et al, 2011; Ji et al, 2011; Liu et al, 2011b; Cui et al, 2014; Zhao et al, 2015	○	○		○	○	○		○	
	脳における活性酸素産生	Sato et al, 2008		○						○	
	拘束で誘発した認知障害	Nagata et al, 2009		○						○	
	脳虚血で誘発した認知障害	Ge et al, 2012		○							○
	敗血症で誘発した認知障害	Zhou et al, 2012a; Liu et al, 2015		○					○		○
	肝切除で誘発した認知障害	Tian et al, 2016		○					○		
	外傷性脳傷害で誘発した認知欠損	Hou et al, 2012		○					○		
	アルツハイマー病	Li et al, 2010; Wang et al, 2011a		○					○		
	老化促進マウスにおける老年性認知障害	Gu et al, 2010		○						○	
	パーキンソン病	Fu et al, 2009; Fujita et al, 2009; Ito et al, 2012; Yoritaka et al, 2013; Matsumoto et al, 2013		○		○				○	○
	出血性梗塞	Chen et al, 2010b		○							○
	脳内出血	Manaenko et al, 2011; Manaenko et al, 2013		○							○

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			細胞	齧歯類	その他動物	ヒト	培養液	生食	水	ガス	その他
脳	脳外傷	Ji et al, 2010		○							○
	外傷性脳傷害	Ji et al, 2012; Yuan et al, 2015		○				○	○		
	CO中毒	Sun et al, 2011b; Wang et al, 2012a; Wang et al, 2012c; Shen et al, 2013		○				○			
	一過性で広範な脳虚血	Hugyecz et al, 2011		○							○
	頸動脈の結紮による脳虚血	Nagatani et al, 2012		○							○
	くも膜下出血における脳傷害	Zhan et al, 2012; Zhuang et al, 2012; Zhuang et al, 2013; Hong et al, 2014; Shao et al, 2015		○	○			○			○
	くも膜下出血における脳血管攣縮	Hong et al, 2012		○				○			
	海馬の循環停止で誘発した脳傷害	Shen et al, 2011		○				○			
	外科的に誘発した脳傷害	Eckermann et al, 2011		○							○
	脳血管結紮で誘発した脳虚血	Li et al, 2012c		○				○			
	LPSで誘発した神経炎症と疾病行動	Spulber et al, 2012		○	○			○		○	
	両側総頸動脈結紮による脳傷害	Nagatani et al, 2013		○							○
心停止蘇生後の脳傷害	Huo et al, 2014		○				○				

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脳	外傷性脳障害で誘発した神経変性	Dohi et al, 2014		○						○	
	クロルピリホスで誘発した神経毒性	Wang et al, 2014		○						○	
	脳卒中における神経学的症状	Takeuchi et al, 2015		○						○	
	脳虚血傷害	Han et al, 2015		○						○	
	低酸素/再酸素化誘発細胞死	Wei et al, 2015		○				○			
	ALS	Zhang et al, 2015		○						○	
	自己免疫性脳脊髄炎	Zhao et al, 2016		○						○	
	うつ様行動	Zhang et al, 2016		○						○	
	外傷性脳傷害後の脳障害と炎症	Tian et al, 2016		○						○	
	脳虚血再灌流障害	Cui et al, 2016; Li et al, 2016		○						○	○
神経/脊髄	脊髄傷害	Chen et al, 2010a; Wang et al, 2015		○						○	
	脊髄の虚血再灌流傷害	Huang et al, 2011b; Zhou et al, 2013			○					○	○
	神経因性疼痛	Chen et al, 2013; Kawaguchi et al, 2014; Ge et al, 2014; Chen et al, 2015		○						○	○
	アストログリア増殖症	Liu et al, 2014		○	○				○	○	
	レミフェンタニル誘発痛覚過敏	Zhang et al, 2014a; Shu et al, 2015		○						○	
	レミフェンタニル誘発高侵害受容作用	Zhang et al, 2014b		○						○	

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神経/脊髄	神経細胞死	Kashiwagi et al, 2014	○				○				
	末梢神経の自己移植	Zhang et al, 2016		○				○			
眼	緑内障	Oharazawa et al, 2010		○							○
	アルカリで誘発した角膜腐食	Kubota et al, 2011		○							○
	網膜傷害	Wei et al, 2012; Tian et al, 2013; Feng et al, 2012; Qi et al, 2015; Zhang et al, 2016		○				○			
	網膜ミクログリア細胞の LPS 誘発炎症	Liu et al, 2013	○					○			
	亜セレン酸誘発白内障	Yang et al, 2013		○				○			
	視神経クラッシュ	Sun et al, 2014		○				○			
	網膜の虚血再灌流障害	Liu et al, 2015; Wang et al, 2016		○				○		○	
	網膜の酸化ストレス	Yokota et al, 2015	○					○			
	光受容体変性	Chen et al, 2016		○				○			
	白内障手術時の角膜内皮障害	Igarashi et al, 2016				○		○			
耳	聴覚障害	Kikkawa et al, 2009; Taura et al, 2010; Lin et al, 2011	○	○				○		○	
	ウアバイン誘発聴器神経傷害	Qu et al, 2012a		○							○
	騒音で誘発した聴覚消失	Zhou et al, 2012b; Kurioka et al, 2014; Chen et al, 2014		○				○		○	

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耳	シスプラチン誘発聴器毒性	Qu et al, 2012b; Kikkawa et al, 2014;	○	○			○				○	
肺	酸素誘発肺傷害	Sun et al, 2011c; Huang et al, 2010; Zheng et al, 2010; Huang et al, 2011a; Kawamura et al, 2013		○				○			○	
	パラコート誘発肺傷害	Liu et al, 2011a		○				○				
	放射線誘発肺傷害	Terasaki et al, 2011; Chuai et al, 2011		○					○			
	火傷誘発肺傷害	Qiu et al, 2010; Fang et al, 2011		○				○				
	腸の虚血再灌流傷害で誘発した肺傷害	Mao et al, 2009		○				○				
	LPS 誘発急性肺傷害	Qiu et al, 2011; Xie et al, 2012a; Liang et al, 2012; Liu et al, 2015; Zhang et al, 2015		○				○			○	
	肺の虚血再灌流傷害	Li et al, 2012b; Shi et al, 2012		○	○			○				
	敗血症ショック誘発性の肺と腸の傷害	Liu et al, 2013		○							○	
	出血性ショック誘発性の肺傷害	Shi et al, 2013; Du et al, 2014a		○				○			○	
	心肺バイパスにおける炎症反応	Fujii et al, 2013		○							○	
	慢性閉塞性肺疾患 (COPD)	Ning et al, 2013		○				○				
心臓死の後の肺灌流	Haam et al, 2015			○						○		

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肺	肺移植におけるドナーの遺伝子変化	Tanaka et al, 2012		○							○
	敗血症由来の肺障害	Zhai et al, 2015; Tao et al, 2016		○						○	
	タバコ誘発肺障害	Chen et al, 2015		○						○	
	出血性ショック誘発肺障害	Kohama et al, 2015		○							○
	肺移植	Noda et al, 2014; Liu et al, 2015		○							○
	海水注入で誘発した肺障害	Diao et al, 2016				○					○
気管	OVA で誘発した喘息	Xiao et al, 2013		○						○	
心臓	急性心筋梗塞	Zhang et al, 2011; Sun et al, 2009; Hayashida et al, 2008; Yoshida et al, 2012; Sakai et al, 2012; Jing et al, 2014		○	○					○	○
	心移植	Nakao et al, 2010a; Noda et al, 2012; Noda et al, 2013		○						○	○ ○
	左心室肥大	Yu et al, 2012		○						○	
	放射線誘発心筋傷害	Qian et al, 2010a		○						○	
	睡眠時無呼吸で誘発された心臓の低酸素症	Hayashi et al, 2011		○							○
	心肺停止蘇生後の脳・心臓障害	Hayashida et al, 2012		○							○

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心臓	心肺停止蘇生後の脳障害	Huang et al, 2013; Hayashida et al, 2014		○	○			○		○	
	虚血再灌流傷害とニトロチロシン産生	Shinbo et al, 2013		○						○	
	心臓の虚血再灌流障害	Tan et al, 2013; Zhao et al, 2014; Zhang et al, 2015; Pan et al, 2015		○				○			○
	低酸素による左心室リモデリング	Kato et al, 2014		○						○	
	糖尿病性心筋症	Wu et al, 2015		○					○		
	心筋細胞の虚血による障害	Xie et al, 2014		○				○			
	ドキシソルビシン誘発心不全	Wu et al, 2014		○				○			
	LPS 誘発心不全	Tao et al, 2015		○				○			
	心停止後の心機能と神経学的転帰	Wang et al, 2016		○						○	
心停止後症候群	Tamura et al, 2016								○	○	
肝臓	住血吸虫に起因した慢性肝炎	Gharib et al, 2001		○						○	
	肝の虚血再灌流傷害	Fukuda et al, 2007; Liu et al, 2014; Zhang et al, 2015; Matsuno et al, 2014		○	○			○		○	
	肝炎	Kajiya et al, 2009a		○							○
	非アルコール性肝炎	Kawai et al, 2012		○					○		
	閉塞性黄疸	Liu et al, 2010; Liu et al, 2016		○				○			

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肝臓	四塩化炭素誘発肝障害	Sun et al, 2011a		○				○			
	肝腫瘍治療における放射線障害	Kang et al, 2011				○		○			
	肝臓の遺伝子発現	Nakai et al, 2011		○				○			
	肝切除による肝傷害	Xiang et al, 2012			○					○	
	肝切除による肝不全	Tan et al, 2014		○				○			
	肝の線維化	Koyama Y et al, 2013		○				○			
	B型肝炎	Xia et al, 2013				○		○			
	エンドトキシン誘発肝障害	Xu and Zhang, 2013		○				○			
	肝硬変の血行動態	Lee et al, 2014		○				○			
	アセトアミノフェン誘発肝毒性	Zhang et al, 2015		○				○			
	肝再生	Yu et al, 2015		○							○
	熱傷における肝機能	Liu et al, 2014		○				○			
低酸素/再酸素化障害	Yu et al, 2015		○	○			○	○			
腎臓	血液透析	Nakayama et al, 2007; Nakayama et al, 2009; Nakayama et al, 2010; Terawaki et al, 2014; Terawaki et al, 2015; Tange et al, 2015				○					○
	腹膜透析	Terawaki et al, 2013				○					○



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腎臓	シスプラチン誘発腎症	Nakashima-Kamimura et al, 2009; Kitamura et al, 2010; Matsushita et al, 2011b		○					○	○	
	ゲンタマイシン誘発腎毒性	Matsushita et al, 2011a		○					○		
	腎移植	Cardinal et al, 2010		○					○		
	腎の虚血再灌流傷害	Wang et al, 2011b; Shingu et al, 2010; Abe et al, 2012; Zeng et al, 2014; Li et al, 2016a; Li et al, 2016b		○			○	○			○
	メラミン誘発尿石	Yoon et al, 2011b		○					○		
	糖尿病腎症	Katakura et al, 2012		○					○		
	慢性腎臓病	Zhu et al, 2011		○					○		
	片側尿管結紮による腎障害	Xu et al, 2013		○					○		
	鉄ニトリロ三酢酸誘発腎毒性	Li et al, 2013		○					○		
	Dahl 食塩感受性ラットにおける心-腎障害	Zhu et al, 2013		○					○		
	横紋筋融解症における腎障害	Gu et al, 2014		○					○		
	自然発症高血圧ラット (SHR) における腎障害	Xin et al, 2014		○					○		
敗血症ショック時の腎障害	Liu et al, 2014		○							○	

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腎臓	造影剤誘発腎障害	Homma et al, 2015		○							○
	腎石症	Peng et al, 2015		○							○
	重症火傷における急性腎障害	Guo et al, 2015		○				○			
	肝移植後の急性腎障害	Du et al, 2016		○				○			
膵臓	急性膵炎	Chen et al, 2010c; Zhang et al, 2012; Zhang et al, 2013; Ren et al, 2014; Zhou et al, 2016; Han et al, 2016	○	○				○	○		○
	外傷誘発膵炎	Ren et al, 2012		○				○			
	タウロコール酸誘発膵炎	Shi et al, 2015		○				○			
	膵臓移植後の虚血再灌流障害	Lou et al, 2015		○				○			
	急性壊死性膵炎	Shi et al, 2016		○				○			
精巣	精巣の虚血再灌流傷害	Jiang et al, 2012a; Lee et al, 2012		○				○			○
	精巣の放射線傷害	Jiang et al, 2012b		○				○			
	生殖細胞の放射線傷害	Chuai et al, 2012a		○				○			
	放射線誘発精子形成障害と造血機能障害	Chuai et al, 2012b		○				○			
	ニコチン誘発性精巣傷害	Li et al, 2013		○				○			
	精子の生存率	Nakata et al, 2015	○					○			
	煙草煙誘発精巣障害	Chen et al, 2015		○				○			
卵巣	シスプラチン誘発卵巣障害	Meng et al, 2015		○				○			

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卵巣	早発卵巣不全	He et al, 2016		○				○			
	卵巣の虚血再灌流障害	Gokalp et al, 2016		○				○			
子宮	子宮内膜症	He et al, 2016		○						○	
胃	ストレス誘発胃潰瘍	Liu et al, 2012		○				○			
	アスピリン誘発胃障害	Xue et al, 2014; Zhang et al, 2014		○					○		
腸	腸移植	Buchholz et al, 2008; Zheng et al, 2009; Buchholz et al, 2011		○				○	○		○
	潰瘍性大腸炎	Kajiya et al, 2009b; He et al, 2013		○				○		○	
	腸の虚血再灌流傷害	Chen et al, 2011; Shigeta et al, 2015		○				○			
	出血性ショックにおける腸管障害	Du et al, 2015		○				○			
	腸閉塞	Okamoto et al, 2016		○				○			
血管	動脈硬化	Ohsawa et al, 2008		○					○		
	アテローム性動脈硬化	Song et al, 2012		○				○			
	バルーンで誘発した血管の内 膜傷害と内膜肥厚	Qin et al, 2012; Chen et al, 2013	○	○				○	○		
	移植血管における内膜肥厚	Sun et al, 2012a		○					○		
	血管傷害	Zheng et al, 2012		○				○			
	糖化最終産物誘発性の血管内皮 傷害	Jiang et al, 2013	○					○			

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血管	塩化カルシウムで誘発した動脈瘤	Chen et al, 2013; Song et al, 2013; Chen et al, 2014		○				○			
	血管内皮機能	Sakai et al, 2014								○	
	血管内皮への単球接着と血管透過性	Xie et al, 2015; Yu et al, 2015	○						○		
	動脈硬化におけるプラーク	Song et al, 2015a		○						○	
	血管平滑筋の肥大・増殖	Zhang et al, 2016	○	○					○		○
筋肉	炎症性及びミトコンドリア性筋炎	Ito et al, 2011								○	
	筋肉疲労	Aoki et al, 2012								○	
	腓腹筋萎縮	Fujita et al, 2011		○						○	
	骨格筋の虚血再灌流障害	Huang et al, 2015		○					○		
	軟部組織障害	Ostojic et al, 2014								○	○
	運動負荷による酸化ストレス	Yamazaki et al, 2015							○		
	筋ジストロフィー	Hasegawa et al, 2016		○						○	
軟骨・骨	NO 誘発性軟骨障害	Hanaoka et al, 2011	○						○		
	微小重力による骨欠損	Sun et al, 2012b		○						○	
	骨減少症	Guo et al, 2012		○						○	
	TNF $\alpha$ 誘発骨芽細胞傷害	Cai et al 2013	○						○		
	骨・軟骨組織の生存率	Yamada et al, 2014	○						○		

対象器官 又は疾患	疾患又は疾患モデル	著者及び報告年	使用動物種				投与形態				
			細胞	齧歯類	その他動物	ヒト	培養液	生食	水	ガス	その他
軟骨・骨	破骨細胞の分化	Li et al, 2014	○				○				
	ステロイド誘発大腿骨壊死	Huang et al, 2016			○			○			
関節	関節リウマチ	Ishibashi et al, 2012; Ishibashi et al, 2014; Meng et al, 2016		○		○		○	○		
	乾癬性関節炎	Ishibashi et al, 2015				○		○	○	○	
歯	歯周病	Kasuyama et al, 2011; Azuma et al, 2015		○		○				○	
	歯周病における大動脈の脂質沈着	Ekuni et al, 2012		○						○	
	歯周組織の老化	Tomofuji et al, 2014		○						○	
	線維芽細胞の酸化ストレス	Xiao et al, 2016	○							○	
皮膚	紫外線を照射した線維芽細胞傷害とケラチノサイトのしわ形成	Kato et al, 2012a	○			○		○			○
	紫外線誘発皮膚傷害	Yoon et al, 2011a; Guo et al, 2012		○					○		○
	急性紅斑性皮膚疾患	Ono et al, 2012				○			○		
	皮膚移植における虚血再灌流傷害	Zhao et al, 2013		○					○		
	紫外線誘発皮膚傷害	Ignacio et al, 2013a		○							○
	褥瘡	Li et al, 2013	○			○		○		○	
	アトピー性皮膚炎	Ignacio et al, 2013b; Yoon et al, 2014		○						○	

対象器官 又は疾患	疾患又は疾患モデル	著者及び報告年	使用動物種				投与形態				
			細胞	齧歯類	その他動物	ヒト	培養液	生食	水	ガス	その他
皮膚	放射線誘発皮膚炎と皮膚障害	Watanabe et al, 2014		○							○
	熱傷の進行	Guo et al, 2015		○					○		
	火傷による炎症	Wang et al, 2015		○					○		
	皮膚の虚血再灌流障害	Liu et al, 2015		○					○		
	局所の放射線照射による皮膚炎	Mei et al, 2014		○					○		
代謝	I型糖尿病	Li et al, 2011; Amitani et al, 2013		○		○		○		○	
	II型糖尿病	Kajiyama et al, 2008; Wang et al, 2012		○		○		○	○		
	メタボリックシンドローム	Nakao et al, 2010b; Hashimoto et al, 2011; Song et al, 2013		○		○				○	
	高コレステロール血症	Zong et al, 2012; Song et al, 2015b		○		○			○		
	糖尿病及び肥満	Kamimura et al, 2011		○						○	
	糖尿病性勃起不全	Fan et al, 2012		○					○		
	糖尿病性網膜症	Feng et al, 2012; Xiao et al, 2012		○					○		
	肝細胞の脂肪酸取り込みと脂質蓄積	Iio et al, 2013		○					○		
	脂質代謝	Kamimura et al, 2016		○						○	
周産期異常	新生児低酸素脳症	Cai et al, 2008; Domoki et al, 2010; Cai et al, 2009		○	○				○		○
	子癇（妊娠高血圧腎症）	Yang et al, 2011; Ushida et al, 2016		○					○	○	

対象器官 又は疾患	疾患又は疾患モデル	著者及び報告年	使用動物種				投与形態				
			細胞	齧歯類	その他動物	ヒト	培養液	生食	水	ガス	その他
周産期異 常	母体低酸素による脳傷害	Liu et al, 2011		○							○
	新生児の高酸素誘発網膜症	Huang et al, 2012		○				○			
	新生児における麻酔薬吸入で誘 発された認知障害	Yonamine et al, 2013		○							○
	新生児の壊死性腸炎	Sheng et al, 2013		○				○			
	胎児の海馬障害	Mano et al, 2014		○							○
	新生児の脳室内胚芽層出血	Lekic et al, 2011		○							○
	LPS 誘発新生児肺傷害	Hattori et al, 2015		○							○
	新生児の神経血管障害	Oláh et al, 2015				○					○
	新生児における麻酔薬吸入で誘 発された母性行動の欠如	Takaenoki et al, 2014		○							○
	新生児の気管支肺異形成症	Muramatsu et al, 2016		○							○
	LPS 誘発新生児脳障害	Imai et al, 2016		○							○
	新生児の虚血性脳障害	Bai et al, 2016		○							○
炎症・アレ ルギー	I 型アレルギー	Itoh et al, 2009		○							○
	敗血症	Xie et al, 2010a; Li et al, 2012a; Xie et al, 2012; Liu et al, 2014a; Liu et al, 2014b; Li et al, 2014; Li et al, 2015a; Li et al, 2015b		○						○	○
	ザイモザン誘発炎症	Xie et al, 2010b; Hong et al, 2016		○							○

対象器官 又は疾患	疾患又は疾患モデル	著者及び報告年	使用動物種				投与形態				
			細胞	齧歯類	その他動物	ヒト	培養液	生食	水	ガス	その他
炎症・アレルギー	LPS/IFN- $\gamma$ 誘発 NO 産生	Itoh et al, 2011	○	○			○		○		
	カラゲニン足浮腫およびマクロファージの TNF $\alpha$ 産生	Xu et al, 2012	○	○			○	○			
	LPS 誘発マクロファージ炎症	Chen et al, 2013	○				○				
癌	舌癌細胞増殖	Saitoh et al, 2008; Saitoh et al, 2009	○				○				
	肺癌細胞で誘発した血管新生	Ye et al, 2008	○				○				
	放射線誘発胸腺リンパ腫	Zhao et al, 2011		○				○			
	癌細胞殺傷作用	Kagawa et al, 2012	○								○
	抗腫瘍作用	Dole et al, 1975		○							○
	抗癌剤の抗腫瘍作用増強	Runtuwene et al, 2015		○					○		
高血圧	モノクロタリン誘発肺高血圧	Wang et al, 2011c; He et al, 2013; Kishimoto et al, 2015		○				○	○		
その他	潜水病	Ni et al, 2011		○				○			
	多能性幹細胞の生存	Kawasaki et al, 2010	○								○
	放射線誘発細胞傷害	Qian et al, 2010b; Qian et al, 2010c	○				○				
	酸化 LDL 誘発細胞毒性	Song et al, 2011	○				○				
	高グルコース誘発酸化ストレス	Yu et al, 2011	○				○				
	AAPH 誘発酸化ストレス	Yanagihara et al, 2005		○					○		
	寿命	Yan et al, 2010			○		○				
	運動負荷による酸化ストレス	Koyama et al, 2008; Tsubone et al, 2013			○	○			○		



対象器官 又は疾患	疾患又は疾患モデル	著者及び報告年	使用動物種				投与形態							
			細胞	齧歯類	その他動物	ヒト	培養液	生食	水	ガス	その他			
その他	運動負荷による代謝性アシドーシス	Ostojic et al, 2014				○						○		
	血小板凝集	Takeuchi et al, 2012		○		○	○	○				○		
	放射線誘発アポトーシス	Yang et al, 2012	○				○							
	ラジカル産生および血液流動性	Kato et al, 2012	○									○		
	骨髄移植における GVHD (移植片対宿主病)	Qian et al, 2013		○								○		
	慢性 GVHD	Qian and Shen, 2016				○						○		
	再生不良性貧血	Zhao et al, 2013		○								○		
	放射線誘発免疫機能障害	Zhao et al, 2014		○								○		
	急性腹膜炎	Zhang et al, 2014		○								○		
	出血性ショック	Du et al, 2014		○								○		
	血液幹細胞移植	Yuan et al, 2015		○								○		
	情報伝達	Sobue et al, 2015		○								○	○	
	組織内濃度	Liu et al, 2014		○								○	○	○
	ヒトリンパ球細胞に対する 12C6 + 重イオン照射	Yang et al, 2013		○								○		
	膀胱下尿道閉塞	Miyazaki et al, 2015		○								○		
口蓋内創傷	Tamaki et al, 2016		○								○			

対象器官 又は疾患	疾患又は疾患モデル	著者及び報告年	使用動物種				投与形態					
			細胞	齧歯類	その他動物	ヒト	培養液	生食	水	ガス	その他	
その他	細胞死と老化	Han et al, 2016	○				○					
	細胞老化	Hara et al, 2016	○				○					

2016年11月末までの掲載論文をMiZ株式会社で調査し本資料を作成した。

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